# 2007 RESEARCH PROBLEM STATEMENT

**Problem Title:** Evaluation of the Effect of Variable Advisory Speed Systems on Queue Mitigation in Work Zones **No.:** 07.01-1

**Submitted By:** Peter Negus (UDOT) and Mitsuru Saito (BYU) **Email:** pnegus@utah.gov and msaito@byu.edu

**Project Champion:** Peter Negus

(UDOT or FHWA employee who needs this research done, will help the Research Division lead this project, and will spearhead the implementation of the results. If the project gets prioritized at the UTRAC conference, a Champion Commitment Form will be required before funding.)

**1. Briefly describe the problem to be addressed.**

BYU research team's previous work on traffic control devices and measures at work zones to reduce queue buildup led to the importance of work zone traffic control planning because traffic control devices alone could not contribute queue mitigation. Literature search and a search for state-of-the-art methods to mitigate queue formation at work zones continued. At the 86th TRB, two systems were identified that are promising to improve traffic flow upstream of the work zones, thus reducing sudden slow downs and conflicts among the drivers. One of them is a variable advisory speed system (microwave radar based) and the other is a queue and speed monitoring system (thus being capable to provide variable advisory speeds to the motorist) based on image analysis method using CCTV. Both methods use several variable message signs to dynamically deliver variable advisory speeds to the driver; they are a type of traveler information systems. The main effect of these systems is that when speed is lower and speed variances are lower at the same time, flow become less unstable, lowering the probability of crashes and unnecessary queue formation due to sudden unstable speed changes. These are state-of-the-art concepts that can be employed where long queues are expected with currently available traffic control measures in the upstream section of work zones. Therefore, it is proposed to test these new concepts to see if they are cost effective in reducing congestions and at the same time in reducing crashes upstream of work zones.

**2. Strategic Goal:** ☐ Preservation ☒ Operation ☒ Capacity ☒ Safety (check all that apply)

**3A. List the research objective(s) to be accomplished:**

1. Evaluate variable advisory speed systems for work zones available in the market
2. Test one or two variable advisory speed systems; if necessary, develop/improve algorithms for dynamic speed evaluation and presentation.
3. Conduct statistical analyses to evaluate cost-effectiveness of selected variable advisory speed systems
4. Prepare a guide to select and use a variable advisory speed system

**3B. List the major tasks to accomplish the research objective(s):** **Estimated person-hours:** 1600hrs

1. Literature search on recent developments in work zone queue mitigation methods
2. Negotiate the use of one or two variable advisory speed systems (VASS) with their providers
3. Select work zones where these VASSes be installed
4. Collect before data focusing on speed reduction, speed variation, and throughput variation
5. Install the selected VASSes
6. Collect after data
7. Conduct statistical analyses and determine their cost-effectiveness
8. Develop a usage guide of VASSes if they are found to be cost-effective
9. Prepare a final report

**4. Estimate the cost of this research study including implementation effort (use person-hours from No. 3B):** $65,000

**5. Indicate type of research and/or development project this is**

Large: ☒ Research Project ☐ Development Project
Small: ☐ Research Evaluation ☐ Experimental Feature ☐ New Product Evaluation ☐ Tech Transfer Initiative
☐ Other: _____

(A small project is usually less than $20,000 and shorter than 6 months)

**6. Outline the proposed schedule (when do you need this done, and how will we get there):**

Once the funds are available, we will start the first preparatory tasks (Phase I) in the remainder of 2007. Actual field tests will be conducted in the construction season in 2008 (Phase II). ****Note-Research Portion** could possibly be lowered some $14,000**. Systems Rental** could possibly be negotiated (68,500).

**7. What type of entity is best suited to perform this project (University, Consultant, UDOT Staff, Other Agency, Other)?**
University, UDOT staff, and with the providers of variable advisory speed systems.

**8A. What deliverables would you like to receive at the end of this project?** (e.g. useable technical product, design method, technique, training, workshops, report, manual of practice, policy, procedure, specification, standard, software, hardware, equipment, training tool, etc.)

A final report summarizing all the tasks proposed in the task schedule, including the results of field tests. The report will include guidelines for selecting a proper variable advisory speed system for a work zone.

**8B. Describe how this project will be implemented at UDOT.**
Once the results of the field tests are found to be cost effective, guidelines will be used by region engineers to apply a proper setup of a variable advisory speed system.

**8C. Describe how UDOT will benefit from the implementation of this project, and who the beneficiaries will be.**
Congestion mitigation at work zones is an important public service, for both safety improvement and queue reduction. The motoring public will be the ultimate beneficiary; also, due to the reduced probability (if proved) of getting involved in crashes in work zones eventually benefit the workers at work zones.

**9. Describe the expected risks and obstacles as well as the strategies to overcome them.**
The expected challenge will be to convince the providers to lend us the equipment at reasonable costs. A project cost of $65,000 was listed in Item 4. This was done because an image-analysis based method may cost about $15,000 and a microwave-based system may cost about $10,000 to rent. This will leave $40,000 for the research team's salary, benefits, travel costs, supplies, communication costs, and indirect costs.

**10A. List other people (UDOT and non-UDOT) who are willing to participate in the Technical Advisory Committee (TAC) for this study:**

| Name | Organization / Division / Region | Phone | Email |
|---|---|---|---|
| Peter Negus | UDOT Construction | 801-965-4242 | pnegus@utah.gov |
| Mitsuru Saito | BYU | 801-422-6326 | msaito@byu.edu |
| District RE Engineer | | | |

**10B. Identify other Utah, regional, or national agencies and other groups that may have an interest in supporting this study:**
NCHRP, FHWA, TRB